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## PINGUICULA (LENTIBULARIACEAE) IN THE SOUTHEASTERN UNITED STATES

C. E. WOOD, JR. AND R. K. GODFREY<sup>1</sup>

FOUR DISTINCTIVE SPECIES of the insectivorous genus *Pinguicula* L. have long been recorded from the southeastern United States. All are members of subgenus *ISOLOBA* (Raf.) Barnhart, a group represented outside of this area by *P. lusitanica* L., of Atlantic Europe and northwestern Morocco, and about six species of South America. Three of the species of the Southeast, *P. caerulea* Walt., *P. lutea* Walt., and *P. pumila* Michx. are of fairly widespread occurrence on the outer portions of the Coastal Plain. *Pinguicula pumila*, with the widest range of all, occurs from southeastern North Carolina to southernmost Florida and the Bahamas and westward to central Louisiana and eastern Texas. The fourth species, *P. planifolia* Chapman, a much less well known plant, centers primarily around the Apalachicola River, in western Florida, but also has been collected westward to Mississippi near the coast.

In the course of extensive field work in western Florida, a conspicuous fifth species, which proves to be undescribed, has been collected in a number of localities by Godfrey. It has subsequently been found to occupy a range from southwestern Georgia and western Florida to southern Mississippi

<sup>1</sup> One of a series of miscellaneous notes and papers arising from researches on the flora of the southeastern United States made possible by a grant from the National Science Foundation and by the interest and support of George R. Cooley in this area. A part of the work of the junior author which contributed to this paper was made possible by National Science Foundation Grant G2010 and a grant-in-aid from the Research Council of Florida State University. Earlier papers in this informal series were R. B. Channell, Reappraisal of two plumose *Rhynchosporas* of the southeastern United States, *Rhodora* 58: 335-343. 1956; C. W. James, Notes on the cleistogamous species of *Polygala* in southeastern United States. *RHODORA* 59: 51-56. 1957, and A new variety of *Stipulicida setacea*. *RHODORA* 59: 98. 1957.

and to have been confused variously in this area with *P. caerulea*, *P. planifolia* and *P. pumila*. Field and herbarium studies of this and the other species of the Southeast show, however, that the undescribed plant is quite distinct from those previously described both in its morphology and ecology.

In the field, the new species immediately attracts attention not only by its characteristic and showy corolla but by its oc-

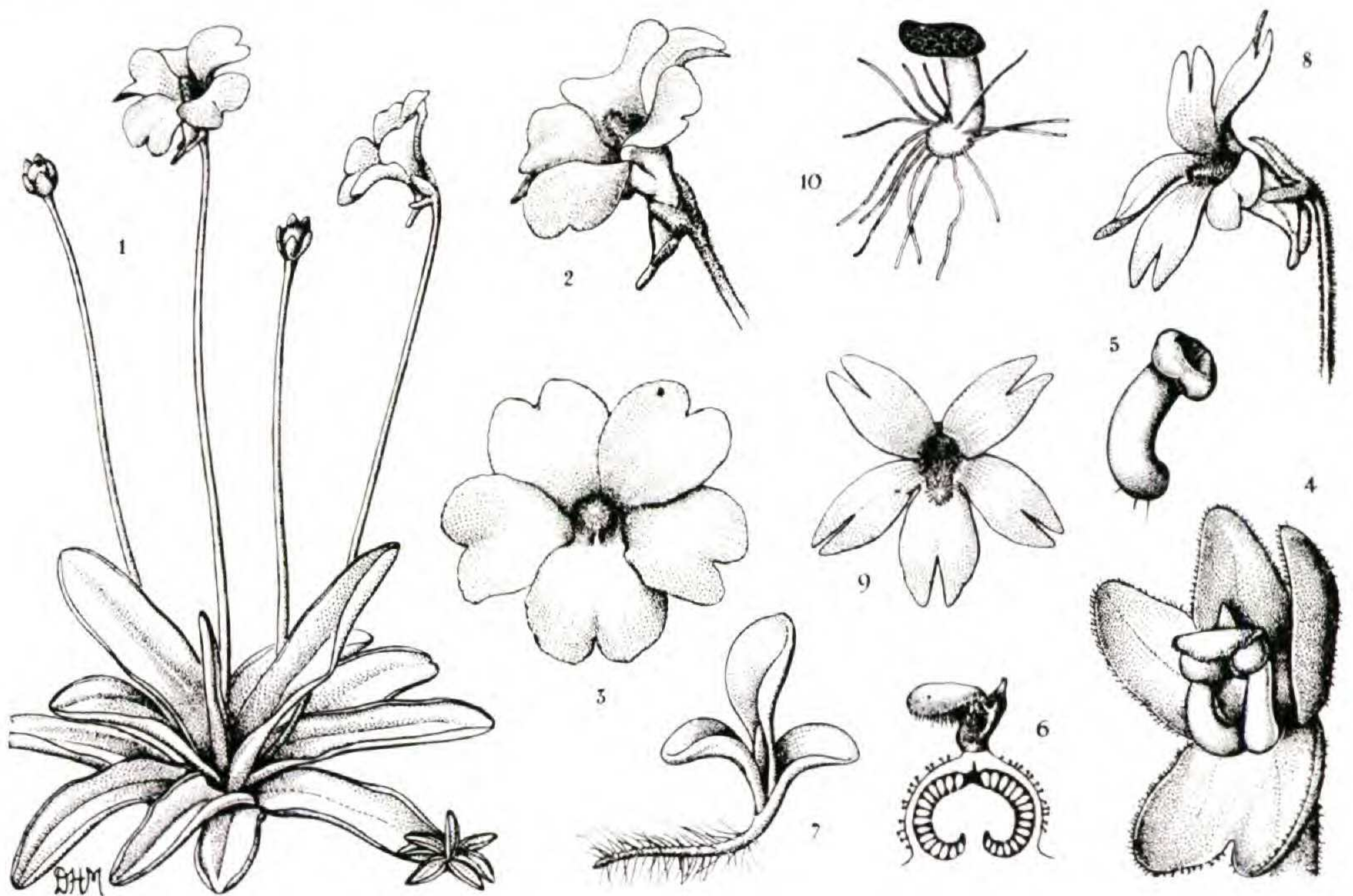


Fig. 1-7. *PINGUICULA PRIMULIFLORA*, Escambia Co., Fla. (see Godfrey 54599). 1. Habit,  $\times \frac{1}{2}$ . 2, 3. Lateral and face-views of corolla,  $\times 1$ . 4. Calyx, stamens and pistil,  $\times 4$ . 5. Stamen,  $\times 6$ . 6. Pistil, the ovary sectioned to show free-central placentation (semi-diagrammatic); note two-lobed stigma with pollen-holding hairs on underside of larger lobe,  $\times 6$ . 7. Seedling, with primary root, hypocotyl, single cotyledon and two leaves,  $\times 5$ . Fig. 8-9. *P. PLANIFOLIA*, Gulf Co., Fla. Corolla, two views,  $\times 1$ . Fig. 10. *P. LUTEA*, Fla., young seedling, with seed-coat, anchoring ring of "root-hairs" at base of hypocotyl, the primary root as yet undeveloped,  $\times 10$ . Drawings by Dorothy H. Marsh.

currence in habitats unusual for *Pinguicula* in the Southeastern States. In western Florida it occurs mostly in the shade of evergreen shrubs or trees in areas with *Sphagnum* or *Pallavicinia*, along spring runs or in springy places, almost always where there is flowing water. In southern Mississippi it seems likewise to be associated, for the most part, with moving water. Dr. R. B. Channell, now of Vanderbilt University, has observed and collected the plant in George and Stone counties, where he found it occurring in grassy tussocks, on the bases of *Nyssa*

saplings, and on mill-timbers, in association with *Orontium* or *Nymphoides* growing in clear, flowing water. Some specimens were collected in moist, sandy soils in pinelands but it may be remarked that these plants are less well developed than those from wetter localities. Dr. James D. Ray kindly visited some of Dr. Channell's localities and others and sent living plants, along with further ecological notes, in the spring of 1957 and has also sent specimens of this species from the herbarium of Mississippi State College. In Stone County, Dr. Ray found the plant associated with *Eriocaulon*, *Lachnocaulon*, *Drosera*, *Helenium brevifolium*, *Selaginella*, and *Mayaca* in the wet, grassy margin of a roadside ditch along the margin of a pine-mixed hardwood thicket (Ray 8020). In Harrison County he reports the plant as local, forming tussocks with *Sphagnum* and *Mayaca* around the bases of *Nyssa biflora* in a shallow pool with an overstory of *Magnolia*, *Ilex*, *Kalmia*, *Viburnum* and *Rhus Vernix* in a second-growth pine wood (Ray 8031).

In contrast to this general ecological picture, *Pinguicula caerulea*, *P. lutea*, and *P. pumila* favor moist to wet, sandy localities, primarily in pine-barrens and savannas. *Pinguicula planifolia* grows in the shallow water of pond-margins or ditches, *Sarracenia* bogs and "flatwoods" depressions, usually with the rosettes submerged (an interesting ecological divergence for a member of this insectivorous genus). In each of these instances, the plants generally grow fully exposed to sun in areas where any surface-water is standing water. In spite of its general association with moving water, the new species, described below, flourishes in *Sphagnum*-filled pots standing in water, a rewarding feature which has made possible the examination of the plant at leisure and in some detail.

***Pinguicula primuliflora*** Wood and Godfrey, sp. nov.

*Pinguicula rosulata crenicola* saepe sphagnicola subgeneris *Isolobae* (Raf.) Barnhart. Folia viridia oblonga, basi spathulata, apice rotundata, (2.5-)6-9 cm. longa, (1-)2-2.5 cm. lata. Scapi 8-15 cm. longi. Sepala 5, 2 infima semicoalita, 2 lateralia oblonga vel ovata, 4-5 mm. longa, 2-3 mm. lata. Corolla (in sicco) (15-)20-26 mm. longa; lobi corollae violaceo-caerulei basi albi, obovati vel suborbiculares aequi, (8-)10-13 mm. longi, 2-3 mm. lati, apice emarginati crenis (1.5-)2-3 mm. profundis; tubus flavus venis brunneis, 4-5 mm. longus, palato conspicuo conico-aciculari, 4-6 mm. longo ex tubo (3-)4-5 mm. exserto. Calcar subcylindricum

flavum, (3-)4-5 mm. longum. Stigma album bilobatum, lobus inferior major. Capsula depresso-globosa, 5 mm. diametro, bivalvata. Semina numerosa subcylindrica, truncata, brunnea, 0.5-0.7 mm. longa.

A *Pinguicula* of subgenus ISOLOBA (Raf.) Barnhart. Flowering rosettes 4-16 cm. wide, the leaves oblong, spatulate at the base, rounded at the tip, (2.5-)6-9 cm. long, (1-)2-2.5 cm. wide. Scapes 1-flowered, ebracteate, 8-15 cm. long at flowering. Flowers (pressed) ca. (15-)20-26 mm. long, including the spur. Sepals 5, the 3 upper free to the base, the lower united about  $\frac{1}{2}$  their length, the lateral sepals oblong to ovate, 4-5 mm. long 2-3 mm. wide. Corolla with nearly equal broadly obovate (or obovate) to suborbicular lobes (8-)10-13 mm. long, 10-14 mm. wide, shallowly notched (1.5-)2-3 mm., widespreading in sunlight, often overlapping, the limb then 15-30 mm. wide. Tube subcylindric, compressed somewhat dorso-ventrally 4-5 mm. long (along the lower side), (3-)4-5.5 mm. wide in pressed specimens, with a conspicuous conic-acicular palate ca. 4-6 mm. long at the base of the lowermost corolla lobe and exerted (3-)4-5 mm. from the mouth of the tube. Corolla tube abruptly contracted into the cylindric spur (3-)4-5 mm. long, forming an angle of 45-60 degrees with the tube. Outer  $\frac{3}{4}$  of corolla lobes wisteria-violet (Ridgeway) to almost white, white at the base, the tube lemon-yellow veined with Brussels brown, especially on the upper side, the spur yellow or with brown veins. Palate densely bearded with slender lemon-chrome clavate-tipped multicellular hairs; throat of tube behind palate with yellow to red smooth, short-stalked, flattened, pyriform or mitten-shaped multicellular hairs. Stamens 2, the anthers pale, the filaments white, the pollen nearly white. Ovary subglobose, glandular, the stigma white, unequally 2-lobed, the lower, larger lobe curving over the anthers. Capsule depressed-globose, ca. 5 mm. in diameter, 2-valved; seeds numerous, minute, 0.5-0.7 mm. long, subcylindric-truncate, brown, the testa of smooth, thick-walled nearly isodiametric cells. (FIG. 1-7, 11-14, 30.)

SPECIMENS EXAMINED: **Georgia.** Early Co.: acid bog, 2 mi. s. of Hilton, *Thorne 2919 & Muenscher*, 10 Apr. 1947 (GH). **Florida.** Escambia Co.: on banks of stream, at very edge of water, and amongst *Sphagnum* in shrub bog, Bayou Marcus Creek, west of Pensacola, *Godfrey 54599*, 26 Mar. 1956 (FSU, GH). Franklin Co.: common, open moist sands of shrub-bog-savanna, 15 mi. n. e. of Eastpoint, *R. Kral 4037a*, 9 Feb. 1956 (FSU). Liberty Co.: several plants on wet sands along margin of railroad ditch, shrub-slash-pine bog, 6 mi. n. of Vilas, *Kral & Godfrey 1960*, 26 Feb. 1956 (FSU). Okaloosa Co.: many plants in shallow water of and on the banks of spring-run, in dense bay-swamp, 1 mi. e. of Crestview, *Godfrey 54553*, 25 Mar. 1956 (FSU, GH). Santa Rosa Co.: in sphagnum evergreen shrub bog, 3 mi. e. of Jay, *Godfrey 54540*, 25 Mar. 1956 (FSU, GH). Walton Co.: in shallow running water, intermixed with *Sphagnum*, in branch-bay woodland, ca. 12 mi. s. of De Funiak Springs, *Godfrey 54408*, 5 Mar. 1956 (FSU, GH); very abundant in shallow running water all over a springy, swampy woodland, intermixed with *Sphagnum*, at Cluster Springs, *Godfrey 54416*, 4 Mar. 1956 (GH-Type; FSU), *Godfrey & Harrison 55396*, 7 Mar. 1957 (FSU, GH); common in sun, fluvial swamp,

6 mi. n. of Portland, *Tyson 694*, 4 Mar. 1952 (GH). **Mississippi.** George Co.: growing on clumps of grass in the edge of Cedar Creek at Miss. Route 63, *Channell*, 2 Aug. 1953 (sterile plants) (GH); mud flats of Cedar Creek, Agricola, *Demaree 34674*, 21 Feb. 1954 (GH); Cedar Creek, not far from Agricola, *Cootey 3399*, *Pease & Demaree*, 3 Apr. 1955 (MISSA). Harrison Co.: Lyman Bog, *Cooley & Ray 3225*, 19 March 1955 (GH, MISSA); local, around base of *Nyssa biflora* in shallow pool, in secondary pine wood, 1 mi. n. of Airey, 3 mi. e. of Saucier, *Ray 8031*, 20 Apr. 1957 (GH, MISSA). Jackson Co.: swampy grass field, ½ mi. n. of Harleston, *Diener 838* (MISSA). Stone Co.: occurring with Goldenclub [*Orontium*], on little knolls in stream and along its edge, among clumps of grass, cool, fresh mill-stream, between Hattiesburg and Wiggins, Highway 45, *Channell*, 9 Apr. 1951 (MISSA); fast moving streams, Wiggins, *Brown*, 1 Apr. 1950 (MISSA); low, moist pinelands in sandy soil, 15 mi. e. of Perkinston, *Channell*, 27 Mar. 1951; floor of pine forest, sandy soil, University Forest Lands, near Perkinston, *Channell*, 4 Apr. 1951 (MISSA); margin of roadside ditch along margin of pine-mixed hardwood thicket, near McHenry, south of Perkinston, *Ray 8020*, 20 Apr. 1957 (fl. and mature fruit) (GH, MISSA). All collections flowering, unless otherwise noted. (Abbreviations for herbaria are those of Lanjouw and Stafleu, *Index Herbariorum*, Part I, ed. 3, 1956.)

*Pinguicula primuliflora* is readily distinguished by the habitat, the oblong leaves, the blue-white-yellow pattern of the corolla, the well-exserted conic-acicular palate, the characteristic form of the fleshy hairs in the throat of the corolla, the widespreading, shallowly notched corolla-lobes, the relatively narrow and short tube, and the spur 4–5 mm. long. Undersized specimens which bear small flowers may be confused with *P. pumila* but the exserted palate and the very different hairs on the palate, at its base, and on the walls of the corolla-tube will immediately distinguish such specimens. The short spur apparently has resulted in confusion with *P. planifolia* but in that species the spur is only 2–3 mm. long, almost sac-like, the corolla is violet to almost magenta with a darker tube, the corolla-lobes are deeply cleft into two acutish segments, and the hairs in the throat of the corolla are quite different.

In the course of working out the characteristics of *Pinguicula primuliflora* a number of observations have accumulated which suggest additional bases for future investigations in the genus. Unfortunately, with much of the *Pinguicula* material (including types) accumulated by the larger herbaria having been destroyed in Berlin during World War II, work on the genus as a whole will be difficult. Enough material is available to us, however,

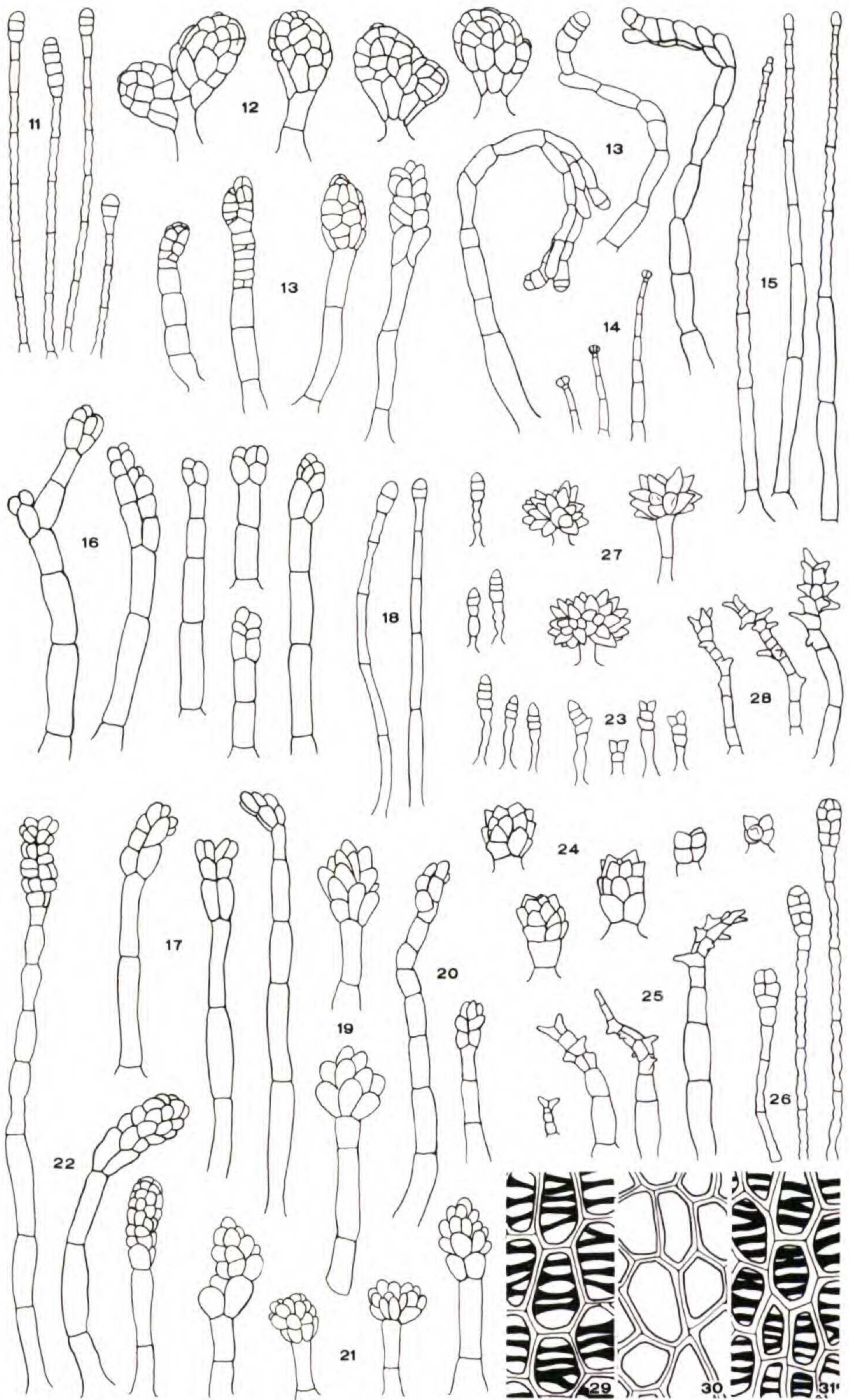


Fig. 11-31. Corolla-hairs and seed-coats of *Pinguicula*. Fig. 11-14. *P. PRIMULIFLORA*, Godfrey 54599, Escambia Co., Fla. 11. Four hairs from palate. 12. Four hairs from base of palate on floor of corolla-tube. 13. Seven hairs from lateral walls of corolla-tube. 14. Three glandular hairs from floor of corolla-tube near base

to show a number of interesting features in those species which occur in the southeastern United States.

Most of the taxonomic characteristics reside within the elaborate corollas which appear to be adapted to pollination by bees or flies. The varying flower-colors, the size of the corolla-lobes, the diameter and length of the tube, the length of the spur, are all features, useful in taxonomy, which must play important roles in the floral biology of each species. Even more interesting is the palate (a conspicuous structure in this subgenus) of varying size and clothed with hairs of varying length, structure, and color, which apparently serve as footholds for the insect visitor. Directly behind the palate on the floor of the corolla-tube is a series of yellow to red shortened, enlarged multicellular hairs. The function of these hairs is not known: although succulent in the living flower, they do not appear to be secretory. Though lacking in *P. caerulea*, they are of distinctive form in each of the four species in which they occur, thereby providing excellent taxonomic characters. Along the lateral walls of the tube are still other multicellular hairs, varying in shape and structure, and also of unknown significance in the functioning of the corolla. (See fig. 11–28.) The characteristic shapes of the hairs are frequently distinguishable even in carefully opened dried corollas and all may be readily observed in corollas which have been re-expanded by soaking or boiling.

The pollination of *Pinguicula alpina* L. and *P. vulgaris* L. (both of subgenus *PIONOPHYLLUM* A. DC.) has been described by Müller (1881; see also Knuth, 1906, p. 133 and 1909, p. 235), who noted the functioning of hairs within the corolla in connection with the pollination of *P. alpina* by flies and that of

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of spur. Fig. 15–17. *P. caerulea*, Wood, 1956, Carteret Co., N. C. 15. Three hairs from palate. 16. Six hairs from walls of tube. 17. Three hairs from base of palate. Fig. 18–20. *P. LUTEA*, Godfrey 52981 & Almodover, Franklin Co., Fla. 18. Two hairs from palate. 19. Two hairs from base of palate. 20. Two hairs from walls of tube. Fig. 21–22. *P. LUTEA*, Channell 2808, Columbus Co., N. C. 21. Four hairs from base of palate. 22. Three hairs from walls of corolla-tube. Fig. 23–25. *P. PUMILA*, Godfrey 54483 & Kurz, Franklin Co., Fla. 23. Eight hairs from palate. 24. Five hairs from base of palate. 25. Four hairs from walls of tube. 26–29. *P. PLANIFOLIA*, living plants, Godfrey, Gulf Co., Fla. 26. Three hairs from palate. 27. Three hairs from base of palate. 28. Three hairs from walls of tube. 29. Cells of seed coat. 30. *P. PRIMULIFLORA*, cells of seed coat. 31. *P. CAERULEA*, cells of seed coat.

*P. vulgaris* by bees. The flower of the former species is of the pinch-trap type with a zone of inwardly directed bristles behind two conspicuous yellow sacs which ornament the entrance to the corolla-tube. The hairs hinder the easy exit of flies visiting the flowers and bring about the contact of the back of the fly with the anthers. The stiff hairs which grasp the body of the fly occasionally imprison the insect within the tube. Although floral biology of the Southeastern species has not been studied, it appears that insects may become trapped occasionally, for on one herbarium specimen of *Pinguicula lutea* a well-preserved one-centimeter-long bee is inclosed within the corolla! The pollination and floral biology of these species should be a fascinating field for further investigation.

In this genus, the precise use of floral characteristics for taxonomic purposes will call for more attention on the part of collectors. The one-flowered scapes of *Pinguicula* mitigate against the dissection of herbarium materials except in cases in which extra corollas have been provided specifically for that purpose. Most pressed flowers are distorted or pressed helter-skelter, while little or no information is given on the original color pattern of the corolla. Although the latter may be obvious in recently collected specimens, the colors inevitably fade with time. It is highly desirable to have additional well-preserved corollas, some spread open to show the palate and the interior of the tube, as well as the lobing of the corolla. Plants of *Pinguicula* are indeed somewhat discouraging subjects for the preparation of herbarium specimens, having as they do slimy, fleshy, brittle leaves which tend to recurve when the tightly packed rosette is dug from the ground. Although the fresh plant is bulky, the leaves dry to fragile tissue-thinness. The use in pressing of wax-paper with the leaves and of cleansing or facial tissue with the flowers will produce excellent results, however.

Although size-measurements are useful in distinguishing between the various species, *Pinguiculas* have the distressing feature of flowering either as small or large plants with the corollas varying accordingly in size. In *P. primuliflora* the limb may vary from 15 to 35 mm. across, the smaller flowered specimens overlapping with *P. pumila* in flower-size. In general,



the length of the spur and that of the palate are less variable (even in small flowers), but even here occasional measurements may overlap in several species.

With most of the taxonomic characters based upon the conspicuous corolla, the less striking and not certainly identifiable fruiting specimens are seldom collected. The seeds, more or less similar in appearance, are all brown, minute (mostly about 0.5 mm. long), and with a seed coat of large, thick-walled cells which produce a reticulate surface. In *Pinguicula caerulea*, *P. lutea*, *P. pumila*, and *P. planifolia* the inner and lateral walls of the cells are thickened only in bands reminiscent of secondary thickenings of xylary elements. The absence of such thickenings in *P. primuliflora* provides another means of distinguishing this species. (See fig. 29–31.)

In connection with the biosystematics of the species occurring in the Southeast, it may be noted that, although two or three species may grow in the same vicinity, there is no evidence of hybridization. All of our species are normally cross-pollinated, abundant seed being set in the wild, but are self-fertile when artificially pollinated. Although *P. primuliflora* readily matures seeds in cultivation, artificial pollination of this species with *P. planifolia*, *P. lutea* and *P. pumila* has resulted in each instance in seeds which either abort before maturity or fail to germinate. Artificial hybrids between members of subgenus ORCHEOSANTHUS A. DC., of Mexico, have been reported however, and two naturally occurring hybrids between species of subgenus PIONOPHYLLUM A. DC., have been described from Europe. The sterile *P. × Scullyi* Druce occurs rarely where the closely related *P. grandiflora* Lam. ( $2n = 64$ ) and *P. vulgaris* L. ( $2n = 64$ ) come together. *Pinguicula × hybrida* Wettst. is morphologically intermediate between *P. alpina* L. ( $2n = 32$ ) and *P. vulgaris* L., and is also sterile, as would be expected.

The only other chromosome-number reported from the genus is that of *P. villosa* L. ( $2n = 16$ ) (Knaben, 1950)<sup>2</sup>, a diminutive arctic species, also of subgenus PIONOPHYLLUM. The polyploid

<sup>2</sup> Áskel Löve has obligingly called our attention to this count and to that for *P. bicolor* Woloszczak,  $2n = 64$  (Zurzycki, J. Studies in *Pinguicula*-species occurring in Poland. Frag. Flor. & Geobot. [Krakow] 1: 16–31. 1953), which was inadvertently omitted. To the numbers included here should also be added that reported by Heitz (Zeitschr. f. Bot. 18: 652. 1925) for "*P. caudata*,"  $2n = 44$ , a member of subgenus ORCHEOSANTHUS.

series of 16, 32, 64 now known from this subgenus (Löve, & Löve, 1944; Doulat, 1947; Knaben, 1950) indicates that counts of other species should be of considerable interest.

The species of the southeastern United States may be distinguished by the following key:

- a. Scapes villous below with long, non-glandular hairs; palate broad, densely clothed with pale hairs; corolla-tube without short, enlarged fleshy hairs at the base of the palate within; corolla-limb violet-blue, the tube greenish, conspicuously ventricose, (6-)7-11 mm. wide (pressed), veined with deep violet, the spur greenish, 5-8 mm. long. . . . . 1. *P. caerulea*.
- a. Scapes not villous below, lacking long, non-glandular hairs; palate with bright yellow hairs; corolla-tube with enlarged, fleshy hairs at base of palate within.
  - b. Palate hardly or not at all exerted from the mouth of the corolla-tube, conical (obtuse in pressed specimens), ascending, about 2 mm. long, clothed with short hairs with obtuse to conical terminal cells; corolla, including spur, 15-20 mm. long, the tube 2-4 mm. wide (pressed), the lateral corolla-lobes (3-)5-7 mm. long, suborbicular, notched about 1 mm. or less, the spur 3-5 mm. long; corolla-limb lavender to white, pink or yellow, the tube violet or yellow. . . . . 3. *P. pumila*.
  - b. Palate conspicuously exerted (usually 3-6 mm.) from corolla-tube, conic to conic-acicular, densely clothed with slender hairs with more or less clavate tips, the terminal cells rounded; corolla usually more than 20 mm. long.
    - c. Spur 2-3 mm. long, sac-like, greenish; corolla-lobes (9-)12-16 mm. long, 7-10 mm. wide, cleft (5-)6-7 mm. into two equal obtuse to acutish segments, violet-blue to magenta, the tube a darker violet; corolla-tube 4-5 mm. wide (pressed), with druse-like stalked hairs of conical- to obtuse-tipped cells at the base of the palate. . . . . 4. *P. planifolia*.
    - c. Spur (3-)4-8 mm. long, cylindrical, yellow; corolla-lobes obovate to orbicular, 8-15 mm. long, 7-16 mm. wide, usually broadly and shallowly notched 2-7 mm. into rounded segments (in No. 2 these segments sometimes more shallowly notched, in turn); cells of stalked hairs at base of palate with rounded tips.
      - d. Corolla chrome yellow, the tube 5-8(-10) mm. wide (pressed), the spur 5-9 mm. long; palate conical, the base with stalked hairs with enlarged tips of clustered, round-tipped cells. . . . . 2. *P. lutea*.
      - d. Corolla-limb violet blue (to almost white), with a white zone at the base, the tube (3-)4-5.5 mm. wide (pressed), lemon-yellow with brown veins, the spur yellow, 4-5 mm. long; palate conic-acicular, the base with short-stalked, smooth, flattened-pyriform to two-lobed (or mitten-shaped) hairs. . . . . 5. *P. primuliflora*.

1. *Pinguicula caerulea* Walt. Fl. Carol. 63. 1788.

*P. elatior* Michx. Fl. Bor.-Amer. 1: 11. 1803.

*Isoloba elatior* (Michx.) Raf. Fl. Tellur. 4: 59. 1838.

DISTRIBUTION: Open, wet, sandy and peaty soils in pinelands and savannas on the outer Coastal Plain, southeastern North Carolina to southern Florida (about the latitude of Lake Okeechobee) and westward to about the Apalachicola River, the distribution almost coinciding with that of *Tephrosia hispidula* (Michx.) Pers. Flowering late February—early May.

*Pinguicula caerulea* stands somewhat apart from the four other species of our area. The pale violet-blue, veiny corolla with its expanded tube and very pale hairy palate is unlike the other species in the Southeast. The enlarged multicellular hairs which characterize all of the latter are lacking and even the hairs on the palate are unlike those of the others.

Walter's name, taken up by Barnhart (1933) in place of the long-used *P. elatior* Michx. appears to be the correct one for this plant. The question of a type-specimen is not clear, however. Although *P. lutea* Walt. is represented in the Walter herbarium (page 83) by a specimen easily recognized from a photograph, from the published illustration it is not so apparent to us that specimen No. 487, on page 104, is "readily matched (as to profile) by . . . a representative sheet of *P. elatior* Michx. (1803) . . ." as suggested by Fernald and Schubert (1948, p. 224 & pl. 113). The corolla of this unmistakable *Pinguicula* is in such a position that only a partial profile, which lends itself as well to *P. lutea* as to *P. caerulea*, can be seen. It is probably either one or the other, but only a careful examination of the specimen itself can determine whether or not *P. caerulea* is actually represented in Walter's herbarium.

2. *Pinguicula lutea* Walt. Fl. Carol. 63. 1788.

*P. campanulata* Lam. Jour. Hist. Nat. Paris 1: 334. 1792.

*P. edentula* Hook. Exot. Fl. 1: t. 16. 1823.

*Isoloba lutea* (Walt.) Raf. Fl. Tellur. 4: 59. 1838.

*I. recurva* Raf. Fl. Tellur. 4: 59. 1838. (An illegitimate renaming of *P. edentula* Hook.)

DISTRIBUTION: Seasonally wet wire-grass and pine savannas of the Atlantic and Gulf Coastal Plains, from southeasternmost North Carolina to about the latitude of Lake Okeechobee, to southwestern Georgia, southern Alabama, southern Mississippi and eastern Louisiana. Flowering mid-February (in the south) to mid-May.

Plants from the Gulf Coast are often far larger, more vigorous and with correspondingly larger flowers than those of the Carolinas. The situation almost suggests that of *Drosera filiformis* and its more robust var. *Tracyi*, except that in this instance no differences other than size are evident nor is there a morphological break between specimens collected in the two areas. *Pinguicula lutea* is not easily cultivated, but the size-characteristics of Carolina and Mississippi plants are maintained at least through a second flowering season in cultivation.

Instead of being one-notched, the corolla-lobes of the species may be three-notched, a characteristic which occurs sporadically. The flower-color is constant and conspicuous, the only variation being in the presence or absence of brown venation in the corolla tube.

A characteristic worthwhile noting is that *Pinguicula lutea* frequently occupies somewhat drier habitats than the other species in our area. Blooming in spring, it may disappear during summer so that one suspects the existence of some method of aestivation (perhaps similar to the formation of winter buds in the boreal species), which permits the recurrence of growth in winter. Herbarium specimens give some indication of the production, under moist winter conditions, of leaves longer and more slender than those produced during the flowering period, thus suggesting somewhat the seasonally dimorphic leaves of some Mexican species of the genus.

3. ***Pinguicula pumila*** Michx. Fl. Bor.-Amer. 1: 11. 1803.

*P. australis* Nutt. Jour. Acad. Nat. Sci. Philadelphia 7: 103. 1834.

*Isoloba pumila* (Michx.) Raf. Fl. Tellur. 4: 59. 1838.

*P. floridensis* Chapm. Fl. Southern U. S. ed. 1. 635. 1883.

*P. pumila* Michx. var. *Buswellii* Moldenke, Phytologia 1: 98. 1934.

DISTRIBUTION: Moist, sandy soil, generally in pinelands and savannas, from southeastern North Carolina, south to the Florida Keys and the Bahamas, and westward to central Louisiana and eastern Texas. Flowering November (tropical Fla.) to July (La.).

This diminutive species is by far the most variable of ours in respect to corolla color. Within a single colony may be found plants with either blue or white corolla lobes and with deeper blue or yellow tubes. (See *Godfrey 54483 & Kurz, Kral 4134 & Godfrey, Kral 4063* [FSU, GH].) Pink forms have been reported,

as well, while *Pinguicula pumila* var. *Buswellii*, from Collier County, Florida, is a form with entirely yellow flowers. Those individuals with blue corolla-lobes and yellow tube may be mistaken for small-flowered specimens of *P. primuliflora*. Under favorable conditions of moisture the rosettes of *P. pumila* may be more than twice the size of those usually collected. Plantlets, moreover, may proliferate from the leaves, a characteristic of frequent occurrence in both *P. primuliflora* and *P. planifolia* where likewise it is probably linked with abundant moisture.

4. ***Pinguicula planifolia*** Chapman, Fl. Southern U. S. ed. 3. 303. 1897.

DISTRIBUTION: Pond margins, ditches, etc., usually submerged, in the region of the Apalachicola River of western Florida (within the area bounded by Leon, Franklin, Gulf, and Walton Counties), westward to coastal Miss. (Jackson Co.: Ocean Springs, F. S. Earle, 8 Mar. 1888 [FLAS]; 8 mi. ne. of Ocean Springs, R. L. Diener 825, 30 Mar. 1953 [MISSA]). Flowering March to April.

*Pinguicula planifolia* is a most distinctive species with its relatively narrow and deeply cleft corolla-lobes, short tube and very short, almost sac-like spur. (See fig. 8, 9.) The stamen-filaments and stigma are violet. Its leaves are similar to those of *P. primuliflora*, but are more elliptic in shape and are usually suffused with reddish-purple color whereas those of *P. primuliflora* are always bright green. This latter characteristic reflects in part, at least, the more exposed habitat of *P. planifolia* for, plants of this species grown under more shaded conditions are green. However, *P. planifolia* becomes purple under light intensities which produce no change in *P. primuliflora*. The almost druse-like hairs at the base of the palate of *P. planifolia* are highly characteristic. It may be noted that, although the plant is described as nearly glabrous (Chapman, Small), it is, as in all of the other species, covered with glandular hairs.

—ARNOLD ARBORETUM, HARVARD UNIVERSITY and DEPT. OF BIOLOGICAL SCIENCES, DIVISION OF BOTANY, FLORIDA STATE UNIVERSITY.

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## NOTES ON THE GRASS FLORA OF THE CHICAGO REGION

S. F. GLASSMAN

THE Chicago region as designated by Swink (1953) includes all or parts of four counties in Illinois (Lake, Cook, Du Page and Will) and parts of three counties in Indiana (Lake, Porter and La Porte). For the past three years I have been studying and collecting grasses with the intention of preparing a grass flora of this region. During this period, many new records were discovered and are reported here along with notes on these and other pertinent grasses.

Specimens cited were examined by me at the following herbaria: Chicago Natural History Museum (F), University of Illinois, Navy Pier (NP), University of Illinois, Urbana (ILL), University of Wisconsin (WIS), and University of Indiana (IND). I want to thank the curators of these herbaria for the privilege of studying their specimens.

*AGROPYRON REPENS* L. forma *ARISTATUM* (Schum.) Holmb. was reported from Lake County, Indiana by Steyermark and Swink (1952). After examining a large number of specimens from the Chicago region, I have concluded that *Agropyron repens* is an exceedingly variable species with no clear cut varieties or forms. In some specimens the lemmas are either all awnless or all awned, whereas in other specimens the lemmas are acute, awn tipped, short awned or long awned on the same plant. Furthermore, it is difficult to follow Fernald's (1950) key to the varieties and forms, especially in the distinction between "glumes abruptly narrowed" versus "glumes gradually tapering from middle." Fassett (1951) states that it is not unusual to find two forms of this species in a single collection and any large patch is apt to contain several forms.

*AGROPYRON SMITHII* Rydb. COOK: Palos Park, June 18, 1909, *Umbach*